

A COMPARISON OF THE SEASONAL GROWTH OF INDIGENOUS AND NON-INDIGENOUS SPECIES IN THE SOUTH-WESTERN CAPE

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ABSTRACT

The shoot growth of four indigenous and five non-indigenous species was investigated at a coastal and a montane site in the South-Western Cape. Forty shoots of each species were labelled and measured at monthly intervals over a period of 12 months. The results were similar to those of Specht (1973, 1975) who observed that non-indigenous *Pinus radiata* and a *Lolium* species exhibit vegetative growth flushes before dominant indigenous South Australian species. Specht suggests that this early growth flush contributes to the invasive success of both *Pinus* and *Lolium*. *Pinus* and *Lolium* are Mediterranean species and their phenology is markedly different from the Australian species. The difference in shooting phenology of the Australian invasive species and four South-Western Cape species studied is not as marked. Nevertheless, the five non-indigenous species exhibit shoot growth peaks slightly before the four indigenous species and this may contribute to their successful invasion of the South-Western Cape vegetation.

UITTREKSEL

'N VERGELYKING VAN DIE SEISOENALE GROEI VAN IN- EN UITHEEMSE SOORTE IN DIE SUID-WESTELIKE KAAP

Die groei van lote van vier inheemse en vyf uitheemse soorte was ondersoek by 'n kus en berg terrein in die Suid-Westelike Kaap. Veertig lote van elke soort is gemerk en maandeliks gemeet oor 'n periode van 12 maande. Die resultate was soortgelyk aan die van Specht (1973, 1975) wat waargeneem het dat *Pinus radiata* en *Lolium* soorte vegetatiewe groeivermeerdering voor die dominante inheemse Suid-Australiese soorte vertoon. Specht stel voor dat die vroeë groeivermeerdering bydra tot die indringende sukses van beide *Pinus* en *Lolium*. *Pinus* en *Lolium* is Mediterreense soorte en hul fenologie is merkbaar anders as die Australiese soorte. Die verskille tussen die lootfenologie tussen die vyf indringer Australiese soorte en die vier Suid-Westelike Kaapse soorte wat bestudeer is, is nie groot nie. Die vyf uitheemse soorte vertoon egter 'n lootgroei piek effens voor die vier inheemse soorte en dit mag bydra tot hul suksesvolle indringing in die Suid-Westelike Kaapse plantegroei.

INTRODUCTION

This investigation was stimulated by Specht's work on seasonal growth patterns exhibited by plants in the mediterranean region of South Australia. Specht observed late spring and summer shoot growth peaks in the dominant indigenous tree, shrub and perennial grass species (Specht 1973, 1975). Both *Pinus radiata* and *Lolium* sp. which are non-indigenous, mediterranean species, exhibited growth peaks during late winter and spring. Specht concluded "the radiata pine trees thus have a strong competitive advantage over native eucalypts in being in a position to make maximum use of limited resources of both nutrients

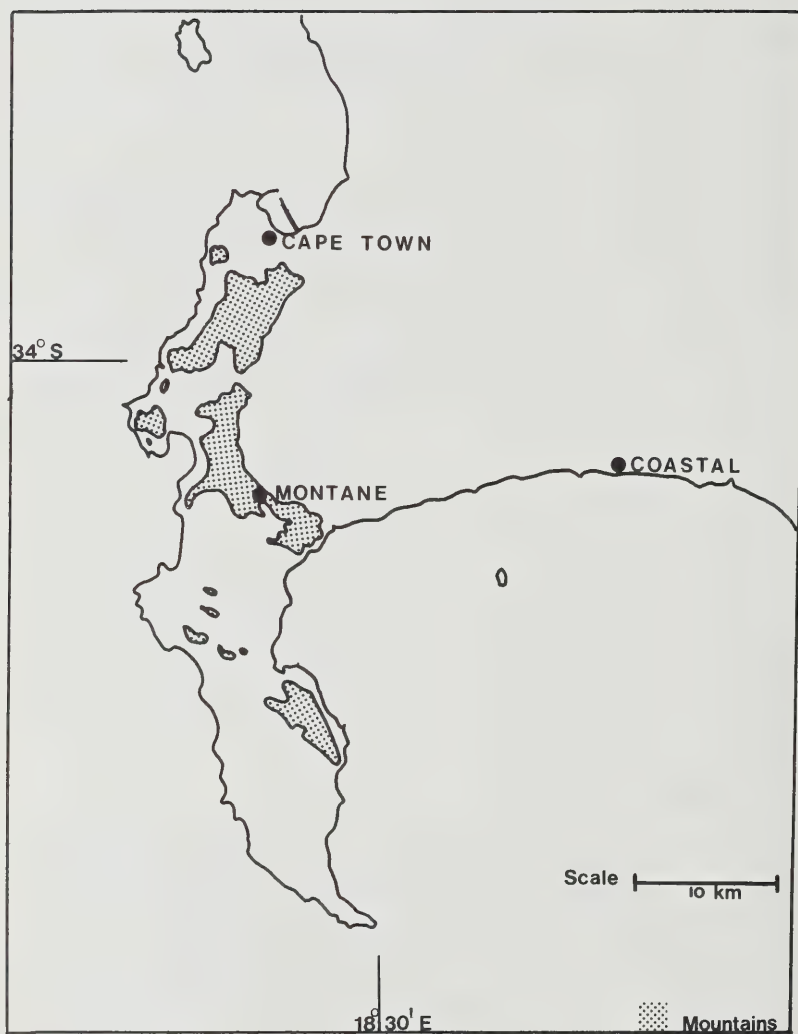


FIG. 1
Map of the Cape Peninsula and environs showing the two study sites.

and water in canopy growth in spring, some months before the native species" (Specht, 1975).

The aim of this study was to investigate whether the same growth pattern held true for several non-indigenous species in the South-Western Cape but no attempt was made to test his conclusions.

Study sites

The study sites, one coastal and one montane (Figure 1), were chosen because they supported both non-indigenous and indigenous species rather than dense non-indigenous stands.

The coastal site was on deep sand and subject to strong SE onshore winds. The montane site was on shallow rocky, sandy loam and experiences greater temperature fluctuations and higher precipitation (Figure 2).

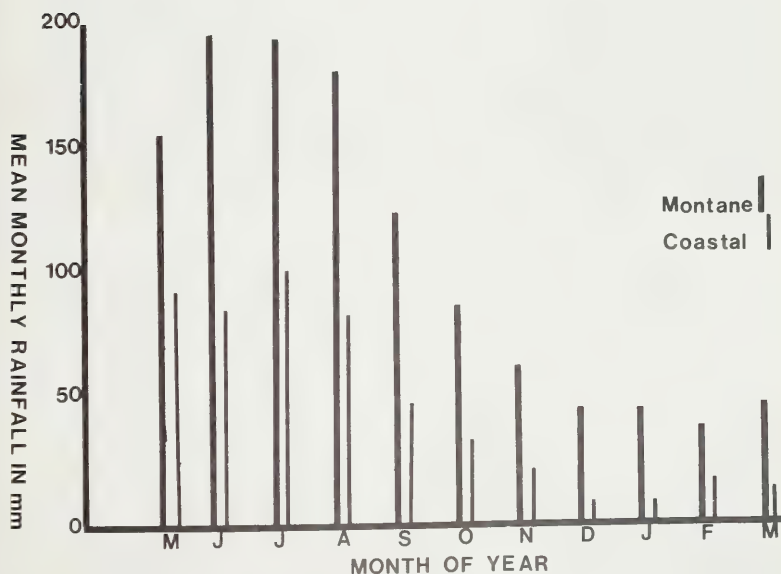


FIG. 2

Mean monthly rainfall data for Silvermine, montane (Cape Town City Council Waterworks, pers. comm., 1980) and D. F. Malan, coastal (Weather Bureau, 1965).

Species investigated

Five common non-indigenous shrub or tree species, two Australian acacias, two hakeas and the mediterranean species *Pinus pinaster* were investigated. The acacias have essentially invaded large lowland areas and the *Hakea* and *Pinus* species montane areas (Stirton, 1978). Four common indigenous shrub species were selected for the suitability of their shoots for labelling and measurement.

TABLE 1.
Species investigated

Species	Coastal Site	Montane Site
<i>Non-Indigenous</i>		
<i>Acacia cyclops</i> A. Cunn. ex G. Don.	✓✓*	✓
<i>A. saligna</i> (Labill.) Wendl.		✓
<i>Hakea gibbosa</i> (Sm.) Cav.		✓
<i>H. sericea</i> Schrad.		✓
<i>Pinus pinaster</i> Ait.		✓
<i>Indigenous</i>		
<i>Berzelia lanuginosa</i> Brongn.		✓
<i>Colpoön compressum</i> Berg.	✓	✓
<i>Myrica cordifolia</i> L.	✓	
<i>Rhus lucida</i> L.	✓	✓

* An exposed and a sheltered individual.

Measurement of relative growth rates

Forty shoots of each species were labelled and measured at approximately monthly intervals from April 1976 to March 1977. Monthly growth was calculated as a percentage of the original length and expressed as a daily rate. A mean shoot elongation rate was calculated for each species.

RESULTS

Figures 3–10 show the mean daily shoot elongation rates each month for the 13 study plants. Table 2 below summarizes the results.

Hakea sericea exhibited a growth peak during August–September (late winter to early spring), (Figure 3).

Both coastal examples of *Acacia cyclops* showed maximum growth rates during spring (September–November), (Figure 4). The exposed individual was severely sheared by the salt and sand-bearing winds; this shearing accounts for the lower shoot elongation rate of this plant compared with the sheltered plant. The windward shoots were long and unbranched, presumably to compensate for

TABLE 2.
Periods of maximum shoot growth

Species	A	S	O	N	D	J	F	M	A	M	J	J
<i>Hakea sericea</i> *	_____											
<i>Acacia cyclops</i> * (coastal)		_____										
<i>Hakea gibbosa</i> *			_____				_____					
<i>Pinus pinaster</i> *				_____								
<i>Acacia saligna</i> *				_____								
<i>Berzelia lanuginosa</i>				_____								
<i>Myrica cordifolia</i>				_____								
<i>Colpoon compressum</i> (coastal)					_____							
(montane)								_____				

* non-indigenous species

the frequent shearing of the tips. The leeward tips were short and much branched. The sheltered individual was taller and not as densely branched as the other. *Acacia cyclops* is most common on the calcareous sands of the Cape Flats (Milton, 1980). The montane example on a sandstone slope appeared to be less vigorous with a lot of dead wood and was apparently in a marginal habitat. For this reason it had a low growth rate as compared with the coastal examples.

Hakea gibbosa showed two small growth peaks in October (spring) and February (late summer), (Figure 3).

Pinus pinaster exhibited slow shoot elongation with a peak in November—December (late spring to early summer), (Figure 5).

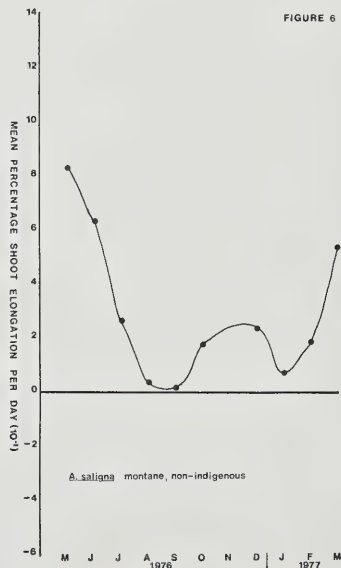
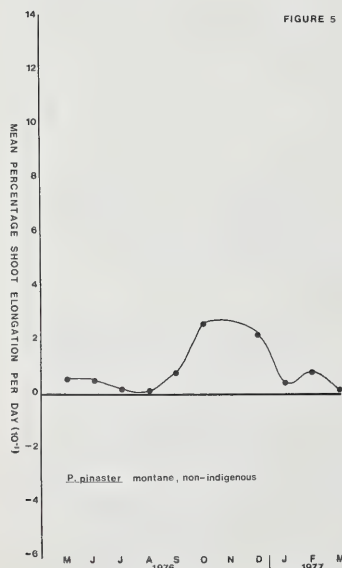
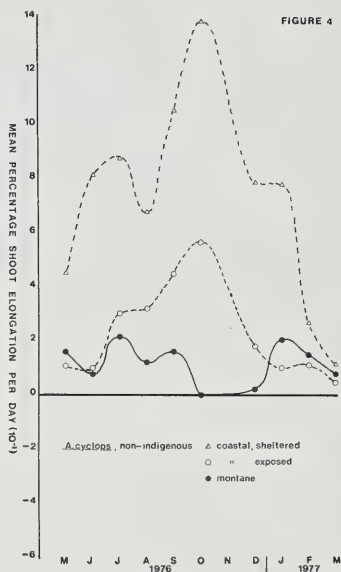
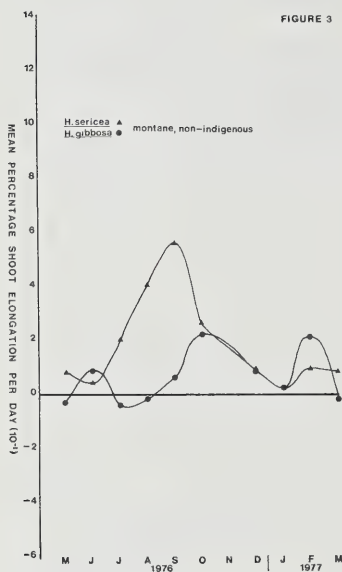
Acacia saligna had an obvious growth peak during autumn (March—May) with a slight increase during November—December (late spring to early summer), (Figure 6). The major growth flush is not during late winter to early summer like the other four alien species. But this growth flush is due to the production of peduncles which do not constitute true vegetative growth. The November—December peak is a vegetative growth flush.

Berzelia lanuginosa exhibited a shoot growth peak during November—January (late spring to early summer), (Figure 7), similar to *A. saligna* and *P. pinaster*.

Myrica cordifolia grew most rapidly during summer (December—February), (Figure 8).

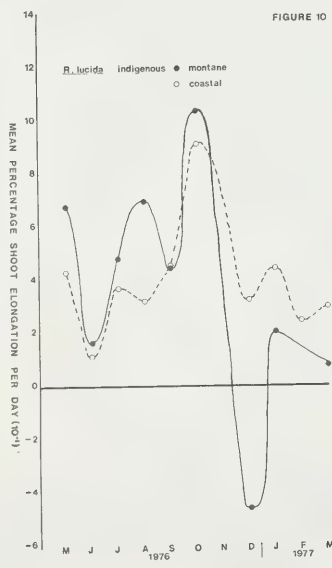
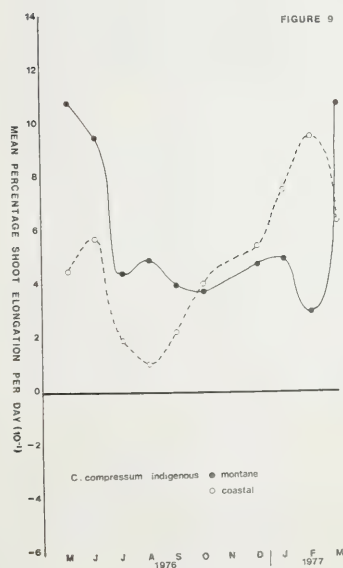
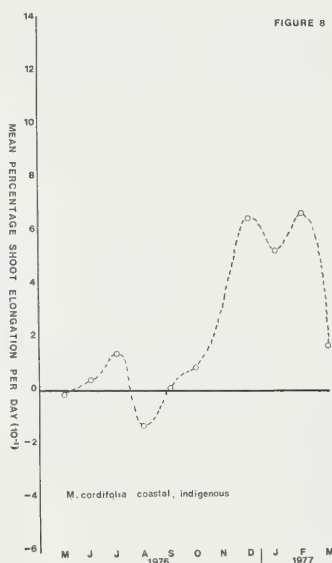
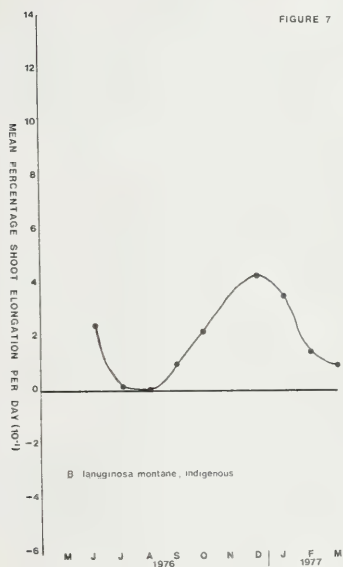
The coastal example of *Colpoon compressum* exhibited a summer growth peak during January and February. The montane example exhibited maximum growth later during autumn (March—May), (Figure 9). This suggests that the growth rhythm is affected by environment and is not genetically fixed.

Rhus lucida was unsuitable for this method of growth measurement. Like *A.*



FIGS 3-6

Mean daily shoot elongation, expressed as a percentage of shoot length the previous month, at approximately monthly intervals.



FIGS 7-10

Mean daily shoot elongation, expressed as a percentage of shoot length the previous month, at approximately monthly intervals.

saligna it has long peduncles which are not strictly vegetative shoots. After flowering during September and October these shoots die and shrivel, or fall off. This explains the negative growth of the montane individual during December, (Figure 10). But I could not distinguish a vegetative growth peak from this peduncle growth as I did for *A. saligna*.

DISCUSSION

In studying shoot growth in this manner two assumptions were made. Firstly, shoot elongation is evidence of increased uptake of water and/or nutrients. Secondly, shoot elongation is an index of increased photosynthetic area. But in the first instance there may be a difference in the lag between uptake and conversion to shoot elongation in different species. In addition current shoot growth may be utilising stored carbohydrates (Groves, 1965; Specht, 1975). The second assumption was not tested, again there may be different lag phases between shoot growth and leaf expansion.

Table 2 and Figures 3–10 show that the non-indigenous species investigated exhibit shoot growth peaks slightly earlier than the indigenous species. I assume that this affords them some competitive, photosynthetic advantage which allows non-indigenous species to out-compete the indigenous species by precocious uptake of water and/or nutrients. To extend this to other communities one must further assume that the indigenous species studied are representative of these communities too. It must also be assumed that growth rhythms are fixed and not affected by habitat (cf. *C. compressum*). It is interesting that *H. sericea*, the most prolific *Hakea* species in the South-Western Cape (Neser and Fugler in Stirton, 1978) grows earlier than *H. gibbosa*.

In this investigation three of the four Australian species exhibited growth peaks before the mediterranean species, the reverse of Specht's findings in Australia. Specht observed that '... the efficiency of exotic pine forest can be triggered only by the addition of essential plant nutrients deficient in most Australian soils' (Specht, 1981). There does not appear to be the same constraint on exotic pines or Australian species in the South-Western Cape. The mediterranean regions of Australian heath and South African fynbos are both characterized by the low nutrient status of their soils by comparison with other mediterranean regions (Specht, in press). As such one might expect Australian but not mediterranean exotics to grow in the South-Western Cape without the addition of nutrients.

CONCLUSIONS

From the shoot elongation data described it appears that three of the five non-indigenous species investigated grew earlier than three of the co-habiting indigenous species. This earlier vegetative growth flush is assumed to confer

some competitive advantage which may contribute to the success of these invasive species in both coastal and montane habitats in the South-Western Cape.

ACKNOWLEDGEMENTS

I would like to thank Dr E. J. Moll for his enthusiasm and supervision during, and discussions after the project. I would also like to acknowledge the help of many friends and relations in collecting and processing the data.

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